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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/080,468	02/22/2002	Hua Ji	M-12589 US	8384

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EXAMINER

MAI, ANH D

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 11/20/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/080,468

Applicant(s)

JI, HUA

Examiner

Anh D. Mai

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 20 August 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-30 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 20 August 2002 is: a) ☒ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

## **DETAILED ACTION**

### ***Amendment***

1. Amendment filed August 20, 2002 has been entered as Paper No. 5. Claims 1, 11, 12, 14-16 and 19 have been amended. Claim 30 has been added. Claims 1-30 are pending.

### ***Drawings***

2. The corrected or substitute drawings were received on August 20, 2002. These drawings are acceptable.

### ***Response to Amendment***

3. The amendment filed August 20, 2002 is objected to under 35 U.S.C. 132 because it introduces new matter into the disclosure. 35 U.S.C. 132 states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: "and no gas flow change as compared to the UBC process" and "and the BUC-deposited film refractive index is about 1.46".

Applicant is required to cancel the new matter in the reply to this Office Action.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1-30 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one

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skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

There does not appear to be a written description of the claim limitation “and no gas flow change as compared to the UBC process” and “and the BUC-deposited film refractive index is about 1.46” in the application as filed.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1-29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term “substantially the minimum necessary” and “providing a minimum flow rate” in claims 1 and 19, respectively, is a relative term which renders the claim indefinite. The term “minimum” is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

The specification and the claims have not defined what is “normal” or “regular”, therefore, the term “minimum” has no base line to compare.

What is the “minimum” ?

Could 0 sccm flow rate be minimum or 100 sccm flow rate be minimum ?

It appears that any flow rate can be considered to be minimum.

*From Previous Office Action*

6. Claims 1-29 are rejected under 35 U.S.C. 112, first paragraph, for containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention, as previously applied.

*Claim Rejections - 35 USC § 102*

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

7. Claims 1-13, 15-28 and 30 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Papasouliotis et al. (U.S. Patent No. 6,030,881) (cited previously).

With respect to claim 1, as best understood by the examiner, Papasouliotis teaches method for filling a gap during integrated circuit fabrication as claimed including:

providing a gas mixture comprised of silicon-containing and oxygen-containing components; and

performing an HDP-CVD process using the gas mixture to fill the gap with a dielectric (525), wherein the ratio of the oxygen containing component to the silicon-containing component is substantially the minimum necessary to form the dielectric. (See Figs. 5A-C).

Note that, the ratio of the oxygen-containing component in the gas mixture of Papasouliotis appears to be substantially the minimum necessary to form the dielectric.

With respect to claim 19, as best understood by the examiner, Papasouliotis teaches method for filling a gap during integrated circuit fabrication as claimed including:

providing a gas mixture comprised of silicon-containing and oxygen-containing components;

selecting a flow rate of the silicon-containing component;

providing a minimum flow rate of oxygen-containing component to allow formation of a film having a refractive index of about 1.46; and

filling the gap by depositing the film (525) over the gaps (510) by using the gas mixture for simultaneous high density plasma chemical vapor deposition and sputter etching (HDP-CVD). (See Figs. 5A-C).

Note that, the flow rate of oxygen-containing component of Papasouliotis appears to be a minimum to allow the formation of a dielectric film.

Further, since the dielectric of Papasouliotis is SiO<sub>2</sub>, thus, it meets the claimed refractive index limitation.

With respect to claims 2 and 5, the silicon-containing and oxygen-containing components of Papasouliotis comprises a concentration by volume of the gas mixture as claimed.

With respect to claims 3, 6, 20 and 22, the silicon-containing and oxygen-containing components of Papasouliotis is at a flow rate that includes claimed range.

With respect to claims 4 and 21, the silicon-containing component of Papasouliotis comprises silane.

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With respect to claims 7 and 23, the oxygen-containing component of Papasouliotis comprises a O<sub>2</sub>.

With respect to claims 8, 10, 24 and 26, the gas mixture of Papasouliotis is further includes an inert component, He.

With respect to claims 9 and 25, the inert component of Papasouliotis is at a flow rate that includes the claimed range.

With respect to claims 11, 12, 27 and 28, the ratio of oxygen-containing component to silicon-containing component of Papasouliotis includes the claimed ranges.

With respect to claim 13, the gas mixture of Papasouliotis is at pressure that includes the claimed range.

With respect to claim 15, the dielectric (525) of Papasouliotis comprises silicon oxide.

With respect to claim 16, the dielectric (525) of Papasouliotis appears to comprises a refractive index as claimed.

With respect to claim 17, the process of Papasouliotis further comprises: providing a low frequency power source operable to form plasma from the gas mixture, the low frequency power source is providing power that includes the claimed range.

With respect to claim 18, the process of Papasouliotis further comprises: providing a high frequency power source operable to bias the substrate, the high frequency power source is providing power that includes the claimed range.

With respect to claim 30, as best understood by the examiner, Papasouliotis teaches method for filling gaps during integrated circuit fabrication as claimed including:

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providing a gas mixture comprised of oxygen-containing and silicon-containing components, the gas mixture having a ratio of oxygen-containing component to silicon-containing component; and

filling the gaps by using the gas mixture for simultaneous high density plasma chemical vapor deposition and sputter etching (HDP-CVD). (See Figs. 5A-C).

Note that, the ratio of the oxygen containing component to silicon-containing component in the gas mixture of Papasouliotis appears to include the claimed ratio.

Further, within purview of one having ordinary skill in the art, it would have been obvious to determine the optimum ratio of the oxygen containing component to silicon-containing component in the gas mixture in the formation of the dielectric layer. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

### ***Claim Rejections - 35 USC § 103***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

8. Claims 14 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Papasouliotis '881.

As best understood by the examiner, Papasouliotis teaches depositing a film over a gap having high aspect ratio including etch/dep ratio is determined by:

$$E/D = (UBUC - BUC) / UBUC.$$



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Thus, Papasouliotis is shown to teach all the features of the claim with the exception of explicitly disclosing the ratio as claimed.

However, since the deposition method of Papasouliotis includes depositing an oxide film in gap having an aspect ratio that greater than the present invention, thus, the E/D ratio of Papasouliotis should at least includes the claimed ratio to fill the gap without void.

Further, given the teaching of Papasouliotis, it would have been obvious to one having ordinary skill in the art, to determine the optimum etch-to-deposit ratio to fill a gap without voids.. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation".

### ***Response to Arguments***

9. Applicant's arguments filed August 20, 2002, with respect to the rejection under 35 U.S.C. 112, first paragraph, have been fully considered but they are not persuasive.

Applicant response with respect to the E/D ratios from about 0.0 to about -0.05 appears to be self-contradicting.

Applicant states: "UBUC is the deposition rate of the process with no wafer bias or clamping (unbias, unclamped) and **no gas flow change** as compared to the BUC process".

The deposition under UBUC means no etch, which means the amount of the SiO<sub>2</sub> formed on the wafer will stay there.

The deposition under BUC means a portion of the deposited SiO<sub>2</sub> will be etch away.

Therefore, the deposition rate of UBUC is **always larger** than (>) the deposition rate of BUC.

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The given equation  $E/D = (UBUC - BUC)/UBUC$

$E/D > 0$  because  $UBUC > BUC$ .

**Where is the negative E/D came from ?**

10. Applicant's arguments with respect to claims 1-29 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

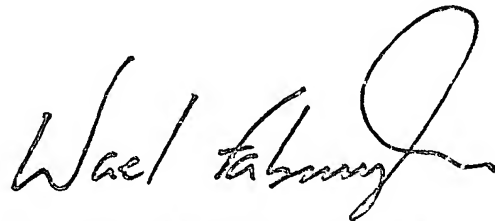
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M  
November 14, 2002

A handwritten signature in black ink, appearing to read "Wael Fahmy". The signature is fluid and cursive, with a large loop at the end.

SUPERVISORY PRIMARY EXAMINER  
TECHNOLOGY CENTER 2000